

UNITED STATES DISTRICT COURT
District of Montana
Helena Division

Tamara Downen,

Plaintiff,

v.

Montana Veterans Home *et al.*,

Defendants.

No. CV-13-121-M-DWM

Supplemental Declaration Of Mark Kroll, PhD, FACC, FHRS

I, Mark Kroll, being of legal age and under the penalties of perjury, state as follows:

1. I am a competent adult and have personal knowledge of the following facts, or believe them to be true based on information and belief. Facts about which I do not have personal knowledge are of the type reasonably relied upon by experts in this field and have probative value to me in rendering my opinions.
2. Attached hereto is a true and accurate copy of my expert report in this litigation.
3. The report summarizes my analysis and findings and includes a statement of my opinions. The report also includes data and other information considered by me in forming my opinions and sets out my qualifications (including my resume).
4. My opinions are expressed to a reasonable, or higher, degree of professional certainty.
5. I affirm under the penalties of perjury that the foregoing statements are true and correct.



Mark Kroll, PhD, FACC, FHRS

7 Jan 2014

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Summary of This Report

I have reviewed and analyzed the Expert Report of Dr. Walter Peschel dated 15 Dec 2013. My opinions from my Expert Report of 1 Dec 2013 have not changed.

In summary, Dr. Peschel opines that the CEW (Conducted Electrical Weapon) current applied to Mr. Downen's left side somehow caused him brain damage. This speculation fails for numerous reasons. As a general background fact, one should bear in mind that most electric fences deliver higher current pulses than does the TASER X26 CEW used in this incident and that the X26 CEW also satisfies all relevant electrical safety standards.¹

I will also comment on Dr. Peschel's understanding of CEW effects for which his personal history is very helpful.

Dr. Peschel's Relevant Qualifications

Education, Training, and Research

Dr. Peschel's training in zoology and medicine were completed before the handheld CEW existed. Even today, the information provided in medical school, on electrical shocks and injuries, is very limited and fits on half of a page.

According to the National Library of Medicine, Dr. Peschel has never published an article and thus there is no evidence of any research or expertise in electrical injuries. Google Scholar also shows no papers or abstracts. His curriculum vitae mentions presentations at St. Patrick's Hospital on chronic illnesses from immune responses and those do not appear to be related to electrical injury.

Personal Experience and Testing

Dr. Peschel has been kind enough to offer details of his own experience with a CEW. This is apparently offered to explain how he has been informed of CEW effects. Presumably it is also proffered to allow the reader to appreciate Dr. Peschel's understanding of CEW effects; in this regard it is very illuminating.

Dr. Peschel recounts numerous sequelae from an encounter with law enforcement, in August 2007, which involved his saving the life of a suicidal woman followed by rough treatment from officers that did not appreciate the help. The account lists "harsh" language, a push to the ground and CEW applications. Dr. Peschel seems to imply that his numerous and long-lasting injuries were the result of the CEW applications and thus my analysis will take that inference.

Peschel: I remembered being handcuffed with arms to my back and then I heard two loud noises and lost consciousness.

The discharge of a CEW makes a single (1) loud "pop" noise as both probes are launched simultaneously. Someone unfamiliar with CEWs might assume that there are 2 "pops" since there are 2 probes but anyone that has fired a CEW, or witnessed a firing, would know that there is a single "pop."

Also, subjects do not lose consciousness when they receive a CEW application.²

Peschel: I was tasered multiple times, apparently for punishment and not for control as I was already handcuffed. When I woke I could not breathe. It seemed to take minutes to regain my ability to breath, and felt like someone was beating on my ribs.

This recollection is unanimously contradicted by numerous studies, which show that the CEW does not interfere with breathing in humans.³⁻⁷ In fact, with an ECD drive-stun application directly over the human phrenic nerves (the nerves that control breathing) there is no effect.⁴

Peschel: I was dazed, but oriented.

Subjects recover immediately, are not dazed, and are able to follow commands within 1 second of a CEW exposure.²

Peschel: After being booked and released, I went to the emergency room. I did not have any fractured ribs, but was diagnosed with an acute myocardial infarction and then discharged.

A CEW will not cause an MI (myocardial infarction). Some MI's are diagnosable by EKG changes and numerous human studies have found no EKG changes from a CEW application.⁸⁻¹⁷ The MI is definitively diagnosed by increased troponin levels in the blood. Nearly a dozen human studies have found troponin increases to range from zero to insignificant.^{5, 8, 14-22} While I do not have access to Dr. Peschel's medical records, it would be highly unusual — if not malpractice — for an emergency department to discharge someone after diagnosing an MI.

Peschel: My subsequent course was a syndrome that can only be explained by electrocution.

"Electrocution" is defined as a death from electrical current.²³⁻²⁶ Rarely, subjects have been literally brought back from an electrocution death, by prompt defibrillation, but that is not relevant as Dr. Peschel does not mention being defibrillated by the police.²⁷⁻³¹ Since Dr. Peschel prepared his Expert Report after his CEW incident, it is highly unlikely that he was "electrocuted." His survival of the exciting incident suggests that his subsequent history is best described by some other syndrome.

Peschel: The next day I awoke with severe tetany. Slight movements caused severe contractions in nearly every muscle of my body. It was extremely painful, and felt like the muscles were pulling off my ribs.

With over 3 million field and training CEW exposures such symptoms have not been previously reported.³²⁻³⁴ There have been a few athletic-type strain injuries, out of over 1.6 million CEW training exposures, but none with such dramatic symptoms.³⁵⁻³⁷

Peschel: I was admitted to the hospital after fainting in the bathtub while attempting to soak my sore muscles. Muscular damage was indicated by a CPK calculated to go over 700. I had almost immediate urinary retention and had to be cathetered [sic]. I developed increased weakness throughout entire body, and particularly in my chest wall.

The median increase in CPK with a CEW exposure is 32 and thus a CPK of 700 was most likely not related to the perceived CEW exposure.^{8, 14-16, 21, 22, 33, 38-42}

Peschel: I couldn't move my chest to properly ventilate my lungs, and my O₂ stats dropped from the normals of 96 down to 80's. My vial [sic] capacity dropped to 40 percent.

With over 3 million field and training CEW exposures such symptoms have not been previously reported.³²⁻³⁴ Since a CEW exposure does not interfere with breathing —

even while the current is being passed — it is highly unlikely that there could be any chronic interference with breathing.³⁻⁷

Peschel: My hands experienced particular weakness, and both median nerves and the right radial nerve had problems with sensation and strength. I developed a gradual stiffness throughout my whole body where I couldn't bend over well to pick things up.

Dr. Peschel does not state where the CEW probes landed in his exceptional exposure and thus it is hard to relate it to weakness in any particular part of the body. Regardless, his stated symptoms are impossible to correlate with a CEW exposure. Assuming *arguendo* that the CEW current is strong enough to cause nerve damage (affecting the hands) then there would have had to have been a probe in each of his left lower arm and his right lower arm so that current was passed thru both arms. That would have required an amazing level of cooperation with the police officers as well as an extremely lucky trick shot. However, that probe arrangement would not have passed current thru the whole body (or even the trunk) and thus the "gradual stiffness throughout [his] whole body" could not have had any possible connection to the CEW exposure.

Finally, the current from an X26 CEW is insufficient to cause any nerve damage.⁴³⁻⁴⁷

Peschel: I suffered both acute and chronic memory problems. I had no concept of time and was constantly looking at my watch. I had some problems with word finding, navigation, and mathematics. I did no reading for a year that amounted to anything. I had no intellectual stamina, and could not concentrate.

A recently published peer-reviewed study showed that there is a minor and insignificant dip in cognitive abilities within the first 15 minutes after any use of force — including the CEW.⁴⁸ However, there is a complete recovery within 60 minutes.⁴⁸ The peer-reviewed scientific literature does not support the possibility of a reading disability lasting a day much less a year. While his report supports a lack of reading the scientific literature on CEW effects, it is hard to blame that on his CEW exposure.

Conclusions:

Someone familiar with CEW effects could construct a colorable personal history of a CEW exposure. Someone unfamiliar with the effects would be unable to do so. Dr. Peschel's recollection of his alleged CEW exposure demands the following conclusions:

1. Dr. Peschel has never received a CEW application.
2. Dr. Peschel lacks a basic understanding of the effects of a CEW.
3. Dr. Peschel's theories are not generally accepted by the scientific community.

Dr. Peschel lacks knowledge, skill, experience, training, and education relevant to electrical injuries — in general — and decidedly so in regards to CEW effects and injuries.

Dr. Peschel's Theory of Injury

Dr. Peschel has offered a creative theory of how the 5-second CEW application contributed to Mr. Downen's death. This complicated conjecture can be broken down for simple analysis into the following steps:

1. The X26 CEW generates sufficient current to cause a permanent cellular injury called electroporation, and
2. sufficient current passed thru the brain to cause electroporation, and
3. this electroporation in the brain accelerated the progression of Mr. Downen's Alzheimer's leading to his death.

Background:

Electroporation involves the passage of extremely high currents (thru tissue) that are so brief that there is no thermal destruction. I.e. the cells in the tissue are damaged by the strong electrical field before they can be damaged by "cooking" or overheating. Most electroporation is reversible (temporary) and is useful for opening cell walls to deliver cancer drugs or genetic material for gene therapy.^{49, 50} There is some evidence that higher currents can cause permanent electroporation but this is somewhat controversial as thermal damage tends to dominate with real-world electrical injuries.^{51, 52} It is probably fair to say that the present consensus is that permanent electroporation is a possible mechanism of injury with extreme currents from sources such as lightning.⁵³

I have an interest in electroporation for both cancer therapy (where it is desirable) and cardiac therapy (where it is to be avoided) and have studied this effect for many years. I have co-authored a dozen papers and book chapters touching on electroporation.^{47, 52, 54-64} In addition, I have edited 2 chapters dedicated to electroporation in some of my books.^{45, 65} My issued US patents discussing electroporation are listed in Table 1.

Table 1. Kroll patents dealing with electroporation.

8,600,494	Method and device for treating abnormal tissue growth with electrical therapy
8,024,048	Method and device for treating cancer with electrical therapy in conjunction with chemotherapeutic agents and radiation therapy
8,014,854	Method and device for treating abnormal tissue growth with electrical therapy
7,848,806	Virtual electrode polarization for shock therapy
7,742,811	Implantable device and method for the electrical treatment of cancer
7,720,549	Partially implantable system for the electrical treatment of abnormal tissue growth
7,412,285	Method and device for treating cancer with electrical therapy in conjunction with chemotherapeutic agents and radiation therapy
6,738,663	Implantable device and method for the electrical treatment of cancer
6,366,808	Implantable device and method for the electrical treatment of cancer

1. Can the X26 CEW Generate Sufficient Current To Cause Electroporation Damage?

The short answer is no. The long answer is that it is certainly not possible beyond a tiny distance from the probe. Fedorov studied this possibility and concluded that electroporation from a CEW probe was not possible.⁴⁵ Panescu modeled this and concluded that reversible electroporation is possible within 1 mm of the tip of the CEW probe as shown in Figure 1.^{47, 52}

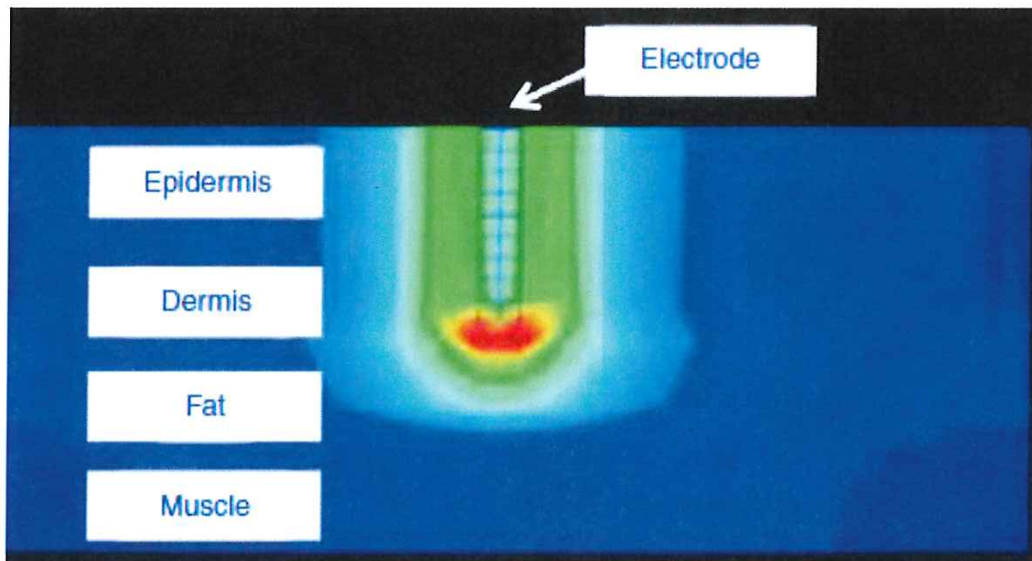


Figure 1. Panescu model showing possible reversible electroporation only at CEW probe tip.

Gowrishankar (see Figure 2) modeled the fields around a hemispherical "drive-stun" electrode and concluded that electroporation was possible within 0.015 mm which is about 1/10 the diameter of a human hair.⁶⁶

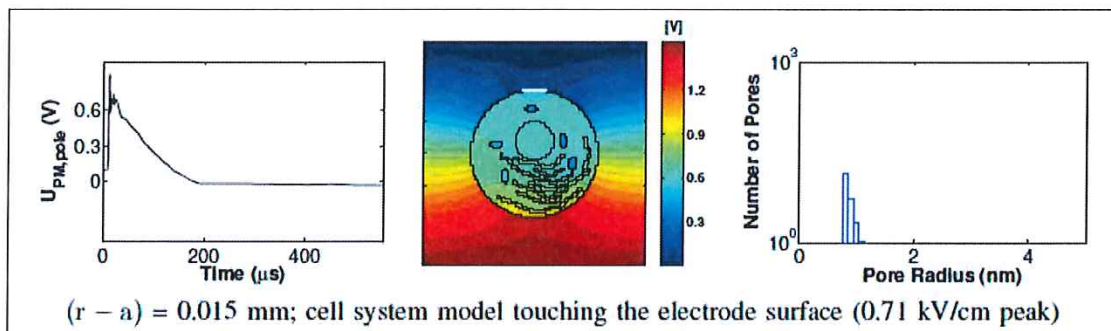


Figure 2. Gowrishankar model showing electroporation within 0.015 mm of electrode.

I take the fairly conservative position that electroporation should be considered as a possibility at both the CEW tip and within an extremely thin layer surrounding the probe. In fact, I have suggested that this might perform a useful sterilizing function which may

explain the absence of infections from the probe penetrations.⁵⁵ Finally, I have suggested the possibility of very localized damage from a probe entering the eyeball.⁵⁶

The X26 CEW cannot cause electroporation more than 1 mm from a probe.

2. Did Any CEW Current Reach Mr. Downen's Brain?

The top probe landed in Mr. Downen's left bicep and the bottom probe landed in his left hip. As shown in Figure 3, the current would have flowed thru the biceps, deltoid, infraspinatus, latissimus dorsi, and finally to the gluteas maximus and medius muscles. No current would have flowed to the brain.

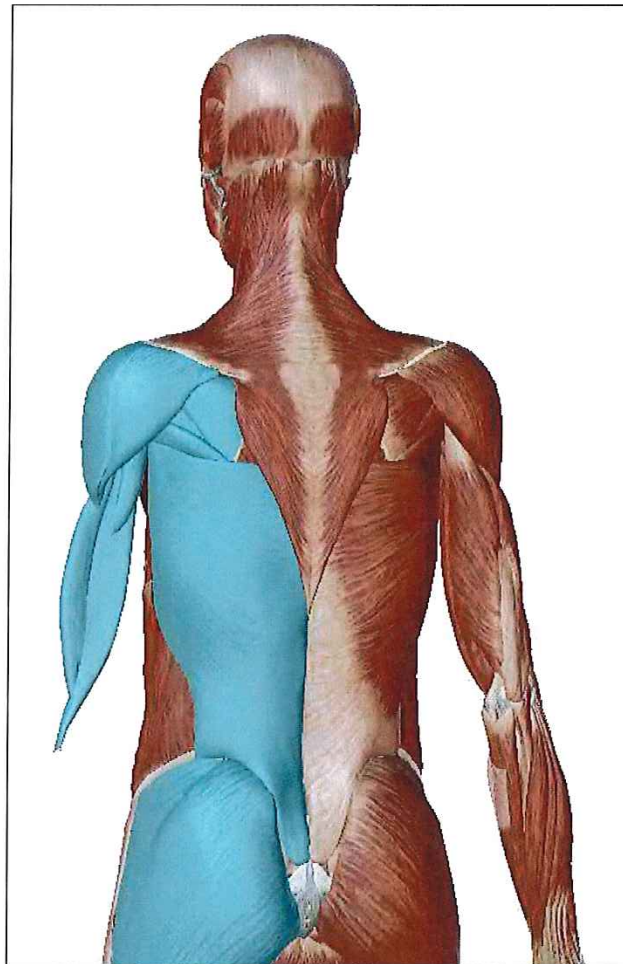


Figure 3. CEW current flow in Mr. Downen.

No CEW current reached Mr. Downen's brain.

3. Could An Electrical Shock To The Brain Accelerate Alzheimers?

Assuming *arguendo* that the probes actually landed in the head, penetrated the skull, and that a CEW could cause electroporation (more than a few cells away), could this have accelerated the progression of Alzheimer's?

Numerous subjects have had their skulls penetrated by CEW probes. In 2% of CEW uses a probe lands in either the head, face, or neck.³⁴ Thus, there have been about 32,000 probes inserted in the neck and above.³⁵ There have been no neurological effects from this direct stimulation of the brain.⁶⁷⁻⁷⁰ There has been a report of a seizure after a probe in the back of the head but that was most likely due to a concussion from the fall from a high-speed run.⁷¹

Interestingly, electrical stimulation has been explored for Alzheimer's patients with results ranging from neutral to positive with no reports of acceleration.⁷²⁻⁷⁵ Finally, a search of the National Library of Medicine finds no case reports of either the initiation or progression of Alzheimers related to electrical shocks.

There is no evidence that an electrical shock to brain will accelerate the progression of Alzheimer's.

Other Relevant Scientific Facts

To fully appreciate just how creative Dr. Peschel's conjecture is, we should consider the electric fence. Typical electric fences have peak currents that are up to 6 times stronger than that of the X26 CEW. See later section "B. CEW Comparison to the Electric Fence." Imagine someone in wet or thin shoes touching an electric fence with their left arm. According to Dr. Peschel's interesting theory, this current thru the arm and down thru the trunk would cause them brain damage. (Since electroporation is mostly caused by a single pulse of high peak current, the multiple pulses of the X26 CEW are not relevant.) This would suggest an epidemic of Alzheimer's among farm and ranch workers and residents.

Over 1.6 million CEW training exposures have been delivered to law enforcement officers.³⁵ There are no reports of cognitive decline or Alzheimer's acceleration.

The American Academy of Emergency Physicians carefully reviewed the literature on CEW effects and published their recommendations in a Clinical Guidance paper.⁷⁶ There is no mention of any need to screen for any of the injuries or effects speculated by Dr. Peschel.

Conclusions

Dr. Peschel's interesting conjectures of a connection between a CEW application and an acceleration of Alzheimer's progression is contradicted by the scientific literature at multiple levels. His theories are not generally accepted by any relevant scientific community. Dr. Peschel's theories have not been subjected to peer review and publication.

Case Specific Materials Reviewed or Considered

Filings

- 2nd Amended Complaint
- Answer of Defendants Columbia Falls PD et al
- Initial Disclosure of Defendant Columbia Falls PD
- Initial Disclosure of Defendant Montana Veterans Home et al

Deposition Transcripts & Exhibits

- Tamara Downen

Incident–Related Investigative Reports

- Montana Medical Legal Panel Report

Incident–Related Police Records

- Columbia Falls Police Department Incident Report
- Statement of Danielle Jones

Photos & Videos

- Lapel Video of Off. Johnson

Medical & Care Records

- Kalispell Regional Medical Center
- Montana Veterans' Home
- Three Rivers EMS - Columbia Falls
- Expressions

Expert Reports

- Dr. Walter Peschel

Exhibits

The exhibits or list of references used as a summary of or support for the information and opinions in this report specifically include each illustration, graphic, chart, and video in this report, referenced in this report, or included in any of the references to this report, as well as any documents, or portions thereof, referenced or cited, or any compilation of documents, are to be considered exhibits to this report and may be utilized as exhibits at deposition and/or trial. These exhibits specifically include, but are not limited to: any document, information, illustration, Microsoft® PowerPoint®, lesson plan, drawing, graphic, video, compilation, etc., that is on, or included in, any of the TASER International, Inc. (TASER) training CDs/DVDs (versions 1 through the current release – which is presently version 19), TASER ECD Research Index, TASER Fact Sheets (TFSS), as well as the TASER¹ Research Compendium, the Arrest-Related Death (ARD) Research Index and Compendium, TASER ECD Field Data and Risk Benefit PowerPoint presentations and Analyses, Volunteer Exposure Reports, spreadsheets, and analyses, Field Use Reports, data, summaries, and appendices, the TASER website (including updates and additions), the www.ecdlaw.info and www.ipicd.com websites, etc. Exhibits also include an ADVANCED TASER M26™ (M26) ECD, TASER X26™ ECD (X26), TASER X2™ ECD, TASER X3™ ECD, fully kitted M26 ECD, fully kitted X26 ECD, fully kitted X2 ECD, fully kitted X3 ECD, TASER cartridges, TASER cartridge wire, TASER probes, a Van de Graff generator, 8 AA cells, 2 Duracell® CR123 cells, an X26 Digital Power Magazine (DPM), an X26 ECD eXtended Digital Power Magazine (XDPM), stacks of 10,000, 25,000, 50,000, and 100,000 sheets of copy-type paper, vehicle battery jumper cables, 110 V alternating current (AC) electrical cords/cables, ground fault circuit interrupter (GFCI), a can of Pepsi® or other soft drink, an empty soda can, a Nikon® F6 camera, and other exhibits and demonstrative aids.

Electric fence energizers of various brands

Electroconvulsive therapy (ECT) generator

Transcutaneous electronic nerve stimulators (TENS) of various brands

Sound recordings of ECDs played at both normal and slow speed

Video: WHEELCHAIR: - Al Quitman Co TASER CAM footage of suicidal 88yr old man 08.10.11.wmv

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A. Current Flow in the Body

The flow of electrical current in the body is well understood and has been the subject of 100's of scientific papers.^{44, 47, 77-85} The simplest analogy is the 1st to 2nd baseline in baseball. See Figure 4. The runners can go directly between the bases but they typically curve out a bit. Similarly, with 2 electrodes in the skin, the current flow "dives" in somewhat just like a runner's path in baseball. The further the electrodes are apart, the deeper the "dive" of the current. This analysis is accurate for a homogenous conductor like saltwater or fat. However, the body's skeletal muscle layer preferable directs current around the outside of the body since electrical current vastly prefers to follow the grain of the muscle instead of going transverse and penetrating into the body.

A runner might deviate somewhat from a straight line but would never run out into the outfield or wander into the bleachers. Similarly, with 2 CEW electrodes on the chest, no current passes into the legs or brain. That would be like a runner going into the outfield and then climbing up into the seats and then back to 2nd base.

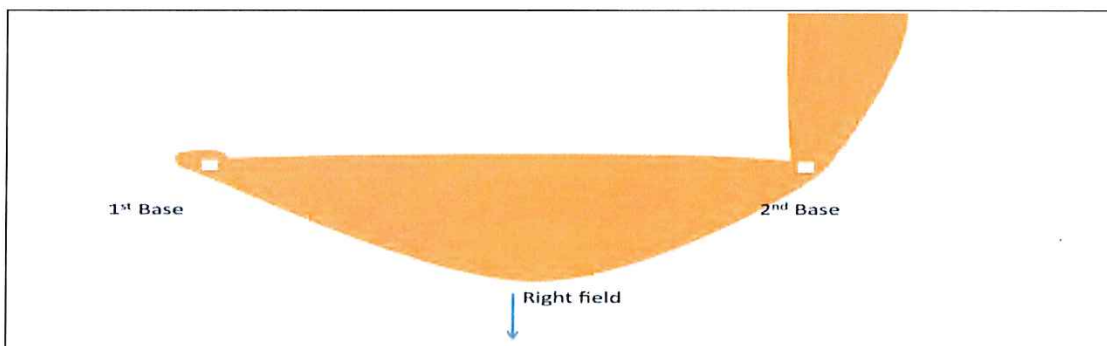


Figure 4. Graphic of electrical current flow in the body analogized to baseball.

Electrical current in the body tends to follow muscle fiber and only deviates slightly.

B. CEW Comparison to the Electric Fence

It is helpful to discuss the most common and longest existing electronic control device — that controls humans and other mammals by giving short painful electrical stimuli — namely the electric fence.

The IEC (International Electrotechnical Commission), the Au/NZS (Australian/New Zealand Standards), European Norm (EN), British Standards, and UL (Underwriters Laboratories) have long had standards for electric fences.^{86, 87} These are the Particular Requirements for Electric Fence Energizers. IEC 60335-2-76, edn 2.1, AU/NZS 60479.1:2010, and the UL Standard for Electric-Fence Controllers in: Laboratories U, ed. UL 69. Independent testing has verified that the TASER X26 CEW satisfies both the IEC, AU/NZS, and UL electric fence standards.¹

Electric fences normally operate on a pulse rate of 1 PPS (pulse per second). This is because they are primarily designed to stop livestock walking slowly toward them. Obviously this slow pulse rate is insufficient to quickly stop a resisting suspect as they can move too far in 1 second. This is why the X26 CEW operates at a rate at 19 PPS. However the electric fence standards do allow operations at higher pulse rates

for a period of up to 3 minutes and have safety standards for those higher pulse rates. (Note that this 3-minute time limit is significantly higher than the total CEW application times alleged in this case.)

The high rate limits are found in section 23.2.4 of the UL standard 69.⁸⁷ It gives a pulse current limit of:

$$I = 20 \cdot T^{-0.7} / \sqrt{\text{PPS}}$$

Where I is given in mA of RMS (root-mean-square) current during the very short "on" period of the pulse. The TASER X26 CEW delivers 0.1 J (joule) per pulse with an inter-barb resistance of 600 Ω (ohms) with a pulse rate of 19 PPS and a pulse width of 100 μ s (microseconds). This gives a pulse current of:

$$\begin{aligned} I_{\text{RMS}} &= \sqrt{U/(RT)} \\ &= \sqrt{0.1 \text{ J} / 600 \Omega \cdot 100 \mu\text{s}} \\ &= 1291 \text{ mA} \end{aligned}$$

The allowed limit is given by:

$$\begin{aligned} I &= 20 \cdot (100 \mu\text{s})^{-0.7} / \sqrt{\text{PPS}} \\ &= 20 \cdot 630.96 / 4.359 \text{ mA} \\ &= 2894 \text{ mA} \end{aligned}$$

The electric fence limit is over the X26 CEW output by:

$$\begin{aligned} \text{Ratio} &= 2894/1291 \\ &= 2.24 \end{aligned}$$

Thus the TASER X26 CEW has only 45% of the output allowed by the UL electric fence standard so it can be seen that the X26 CEW satisfies the electric fence standards by a very wide margin. Another comparison can be made between the outputs of the TASER X26 CEW and the Stafix electric fence energizer shown in Figure 6 which delivers 7 watts with a peak current of 17.2 A.

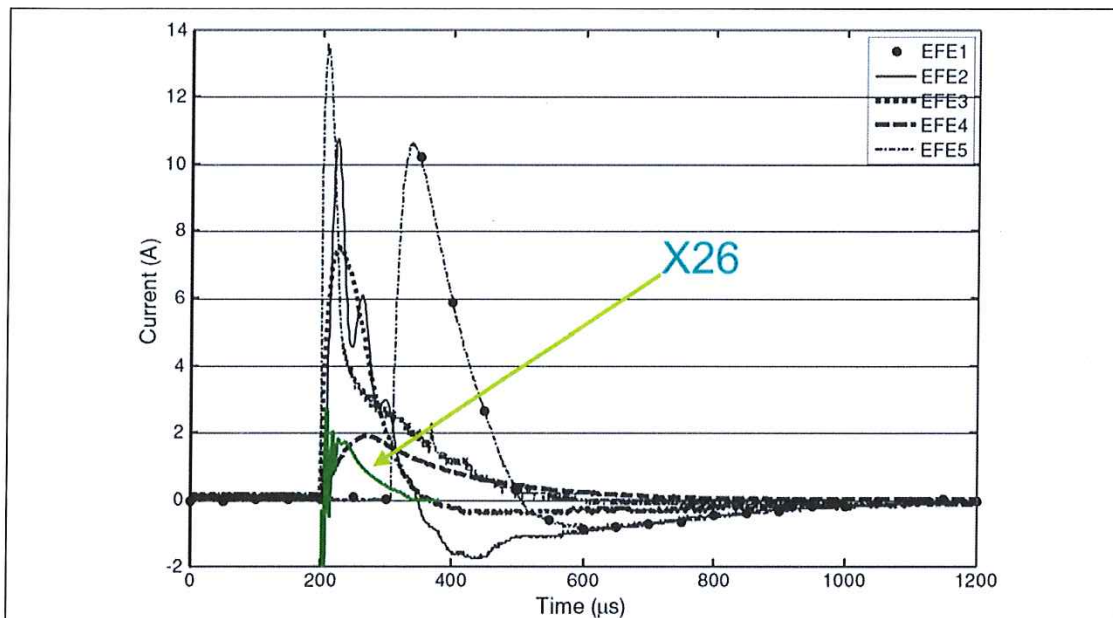


Figure 5. The X26 CEW pulse delivers less current and charge than many electric fence units.

The electric fence standard has evolved from almost 100 years of experience with documented fatalities from earlier high-powered devices. The UL carefully collected data on these units to find out what was a safe limit. The typical accidental exposure to an electric fence is based on someone walking into it and thus is a frontal exposure. Depending upon the relative heights of the fence and the individual this exposure could be anywhere from the face to the thighs and could include skin penetration from barbs on barbed wire. These limits are very stringent and now fatalities from electric fences are almost unheard of in spite of there being on the order of 100,000 miles of electric fence in the United States alone.



Figure 6. The Stafix M63R electric fence energizer.

The TASER X26 CEW satisfies UL electric fence standards by a wide margin and can be thus deemed very safe.

C. The TASER CEW Has Led to Dramatic Reductions in Injury.

Numerous published studies have now clearly demonstrated substantial injury reductions from the use of TASER CEWs compared to alternative control techniques.^{32, 88-97}

A partial list of these studies includes:

1. MacDonald which compared the CEW to pepper spray and "physical force."⁹⁰
2. Taylor which compared the CEW to pepper spray, baton strikes, and "hands-on."⁸⁹
3. Mesloh who studied CEW usage in comparison to many control options.⁹⁷
 - a. Gentle hold
 - b. Handcuff
 - c. Leg restraints
 - d. Pepper spray
 - e. Compliance holds
 - f. Takedown
 - g. Empty hand strike
 - h. FN303/Pepperball
 - i. Impact weapon
 - j. Canine

The largest epidemiological study was the 2009 MacDonald study of 24,380 uses of force.⁹⁰ This study found that CEW usage dramatically reduced both suspect and officer injury compared to alternative force options. Additional studies demonstrating injury reduction are memorialized in the papers of Taylor (13,983 subjects), Mesloh (n = 4303), Smith (n = 1645), Butler (n = 562), and White (n = 243).^{89, 90, 97-100}

On average, the use of the CEW reduces suspect injuries by about 2/3. To put it another way, the use of alternative control techniques triples (3x) the risk of injury to subjects.

- a. The deployment and use of TASER CEWs has been shown to reduce injuries to officers and suspects over other force options, including physical force.
- b. The deployment and use of TASER CEWs has been shown to reduce officers' workers' compensation claims for use-of-force and arrest-related injuries.
- c. The deployment and use of TASER CEWs has been shown to reduce use-of-force citizen complaints and law enforcement internal affairs complaints against law enforcement officers.¹⁰¹
- d. The deployment and use of TASER CEWs has resulted in the reduced need to use of deadly lethal force.
- e. Rates of injury from TASER CEWs is comparable to, or less than, some collegiate contact and exertion sports.
- f. Rates of injury from TASER CEWs is less than several other common law enforcement force options, including, but not limited to: physical force, batons, impact tools, canines, rubber bullets, and bean bags.
- g. The deployment and use of TASER CEWs has been found to be a lower risk than most personal force options, including: baton, chemical spray, and pepper spray.
- h. TASER CEWs are a safer alternative than other comparable law enforcement force options tools or techniques.

- i. TASER CEWs are shown to reduce suspect injuries when compared to physical force options.
- j. TASER CEWs are more effective in gaining volitional compliance through presence intimidation than other force options.
- k. TASER CEWs have greater accountability features than any other force option.
- l. TASER CEWs are the most studied force option available to law enforcement.
- m. TASER CEWs are the most effective force option in accomplishing intended effects for U.S. law enforcement.
- n. According to peer-reviewed literature, the TASER CEW causes less-severe physiologic and metabolic effects than other force options.
- o. According to peer-reviewed literature, the TASER CEW is the safest force option available to law enforcement.

The TASER CEW reduces suspect injuries.

General Comments

Previous Testimony

I have testified as an expert at trial or by deposition within the preceding 4 years in:

1. criminal case of *Iowa v. Cruise* (Jul 2010)
2. excessive force case of *Salisbury v. County of Itasca, MN* (Oct 2010)
3. criminal case of *Louisiana v. Nugent* (Oct 2010)
4. defibrillator patent case of *Cardiac Science v. Philips Electronics*. (Jan 2011)
5. wrongful death case of *Carlock v. Sangamon County, Illinois*. (Jul 2011)
6. wrongful death case of *Batchan v. City of Vernon, CA* (Dec 2011)
7. wrongful death case of *Piskura v. TASER International, Inc.* (Dec 2011)
8. wrongful death case of *Wilson v. Gee (Hillsborough Cty, FL)* (Jan 2012)
9. product injury case of *Fahy v. TASER International, Inc.* (Aug 2012)
10. wrongful death case of *Russell v TASER International, Inc.* (Oct 2012)
11. wrongful death case of *Firman v Del Norte County, CA.* (Jan 2013)
12. injury case of *Barnes v Manatee County, FL.* (Jan 2013)
13. injury case of *Jones v City of Chicago* (April 2013)
14. wrongful death case of *Veloz v Bonetti et al (Orange Cty, FL)* (April 2013)
15. patent case of *Philips v Zoll (Boston, MA)* (April and Dec 2013)
16. Coroner's inquest for *Firman (Barrie, Ontario)* (Jul 2013)

Fees:

My fees for this expert witness report are \$400 per hour for the research and preparation. My fees for testimony are \$480 per hour, with a minimum of \$2000, and \$240 per hour for travel, plus actual out-of-pocket expenses. Deposition fees and expenses are due prior to the commencement of the deposition.

Right To Amend:

The opinions in this report are living opinions. Should additional discovery material be received, or additional research be completed, and then reviewed, these opinions may be altered or reinforced depending upon what information is obtained, reviewed, or studied. If new issues are opined, identified, or developed subsequent to submission of this report, I reserve the right to supplement, or further supplement, this report. I especially reserve the right to amend my report after receiving the Plaintiff's expert reports or new forensic evidence.

Further Development:

Further, the opinions, which are expressed in this report, are not necessarily fully developed. Rather, they are listed to comply with current report requests. Each opinion may be further developed through research, investigation, during deposition or trial testimony.

Specific References:

Some of the opinions in this report may list specific references to some of the case specific documents reviewed or considered. These listings are not intended to be all-inclusive. I specifically reserve the right to supplement the support for each of the opinions in this report.

Opinion Methodology:

The following opinions were developed using the disciplines of bioelectricity, electrophysiology, biomedical engineering, cardiovascular physiology, scientific methods, mathematics, and physics and are to a reasonable degree of professional, scientific, or medical certainty.

Additionally, the opinions provided in this case were developed using one or more qualitative and quantitative research methodologies, in addition to my education, training, experience, and literature review.

Scientific Method

My scientific specialty is bioelectricity or the interaction of electricity and the body. I have invested most of my career researching and developing electrical devices to diagnose and treat disease. The primary focus is the effect of electrical shocks on the human body. This investment has resulted in every Implantable Cardioverter Defibrillator (ICD) made anywhere in the world licensing some of my patented improvements.

This involves researching, lecturing, and publishing on electric shocks and their effects on the human body. It includes lectures throughout Europe and Asia (in over 30 countries) as well as at many of the major universities and medical centers of the United States (U.S.). Usually, the typical audience member is a cardiologist electrophysiologist or medical examiner. With over 340 issued U. S. patents and numerous pending and international patents, I currently hold the most patents on electrical medical devices of anyone in the world. Over 1 million people have devices with some of these patented features in their chest, monitoring every heartbeat.

<http://www.startribune.com/business/22114119.html>

In 2010 was awarded the Career Achievement Award by the Engineering in Medicine and Biology Society which is arguably the most prestigious award given internationally in Biomedical Engineering.

<http://tc-therapeutic-systems.embs.org/whatsnew/index.html>

Believed to be the only individual to receive the high "Fellow" honor from both Cardiology and Engineering societies. To wit:

- 1997 Fellow, American College of Cardiology
- 2009 Fellow, Heart Rhythm Society
- 2011 Fellow, IEEE Engineering in Medicine and Biology Society
- 2013 Fellow, American Institute for Medical and Biological Engineering

Author of over 200 abstracts, papers, and book chapters and also the co-editor of 4 books:

1. Implantable-Cardioverter Defibrillator Therapy: The Engineering-Clinical Interface. Kluwer 1996
2. Cardiac Bioelectric Therapy: Mechanisms and Practical Implications. Springer-Kluwer 2008
3. TASER® Conducted Electrical Weapons: Physiology, Pathology and Law. Springer-Kluwer 2009.
4. Forensic Atlas of Conducted Electrical Weapons: Springer-Kluwer 2012

Directly relevant paper publications include 30 papers, book chapters, and indexed letters on TASER CEWs as well as numerous CEW scientific abstracts:

1. Brewer J, Kroll MW. Field Statistics Overview. In: Kroll M, Ho J, eds. TASER Conducted Electrical Weapons: Physiology, Pathology, and Law. New York City: Springer-Kluwer, 2009.
2. Dawes D, Kroll M. Neuroendocrine Effects of CEWs. In: Kroll M, Ho J, eds. TASER Conducted Electrical Weapons: Physiology, Pathology, and Law. New York City: Springer-Kluwer, 2009.
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15. Kroll MW. TASER Conducted Electrical Weapons. Chapter in *Clinical Forensic Medicine 3rd Ed*, edited by Margaret Stark. Humana Press 2011.
16. Kroll MW. TASER® Electronic Control Devices. In: Fish R, Geddes L, eds. *Electrical Injuries: Medical and Bioengineering Aspects*. Tucson, AZ: Lawyers and Judges Publishing Company, Inc., 2009:455-491.
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There have also been many presentations on CEWs to scientific and medical audiences. These include: 2007 AAFS (American Academy of Forensic Science) conference major presentation in San Antonio, Texas¹⁰² and the 2007 BEMS (Bioelectromagnetic Society) meeting Plenary Address in Kanazawa, Japan.¹⁰³

1. Major invited lecture at the 2006 NAME (National Association of Medical Examiners) conference in San Antonio, Texas.¹⁰⁴
2. Advanced Death Investigation Course of St. Louis University (2007) as faculty lecturer to full audience.¹⁰⁵
3. Faculty lecturer to full audience at Institute for the Prevention of In-Custody Death Conferences (2006 and 2007), Las Vegas, Nevada.
4. Chair of special session on TASER CEW at 2006 Cardiostim meeting in Nice, France.
5. Guest lecture to U.S. Military on CEW in 2006.
6. "Presenting Rhythm in Sudden Custodial Deaths After Use of TASER® Electronic Control Device," was presented at the 2008 scientific conference of the Heart Rhythm Society.¹⁰⁶
7. "Can Electrical-Conductive Weapons (TASER®) alter the functional integrity of pacemakers and defibrillators and cause rapid myocardial capture?" was presented at the 2008 scientific conference of the Heart Rhythm Society.¹⁰⁷
8. "Weight-Adjusted Meta-Analysis Of Fibrillation Risk From TASER® Conducted Electrical Weapons" presented at the 2009 AAFS conference.¹⁰⁸
9. "Meta-Analysis Of Fibrillation Risk From TASER® Conducted Electrical Weapons as a Function of Body Mass" presented at the 2009 scientific conference of the Heart Rhythm Society.¹⁰⁹

In addition to the major addresses above, there have been lectures at the United States Department of Justice (2007), AAFS (2006), and BEMS (2006) regarding the TASER ECD.

I have shot TASER CEWs numerous times and have personally experienced an X26 CEW probe deployment discharge directly to the center of my chest. I have sat on the TASER corporate board since Jan 2003 and their scientific and medical advisory board since Aug 2004.

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